

# PATENT SPECIFICATION



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Bur. Ind. Eigendom

## PROVISIONAL SPECIFICATION

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### Improvements in or relating to Dynamo Electric Instruments

We, S. SMITH & SONS (MOTOR ACCESSORIES) LIMITED, a British Company, of Cricklewood Works, Cricklewood, London, N.W.2, and EDWIN CLAUDE KLEPP, a British Subject, of the same address, do hereby declare the nature of this invention to be as follows:—

This invention relates to dynamo electric instruments having a rotor and a stator, one of which, usually the stator, comprises a tubular core having slots in which the conductors of a winding are carried.

Previously, the slots in the tubular core have been so formed as to be open at the inner wall of the tubular core and in cases where the diameter of this inner wall is small the introduction of the conductors into the slots is extremely difficult, particularly if the total cross-section of the winding is large with respect to the size of the core.

According to the present invention the tubular core is formed with slots which are open at the exterior wall, the interior wall of the core being unbroken. These slots conveniently extend to the exterior wall at full width to enable the winding to be introduced as a whole instead of the conductors having to be introduced into the slots individually.

The invention is especially applicable to electric indicating or repeating instruments in which the winding is in a plurality of sections which may be differently energised to provide a variable field distribution so that the rotor and the stator take up different relative positions,

depending upon this field distribution. It is generally convenient for the stator to have the distributed windings and for the rotor to move within the stator. Such electric indicating or repeating instruments are described, for example, in Specifications Nos. 5012/39 and 12079/39. In these instruments it is usual to provide a sleeve of magnetic material in the air gap to minimise the non-uniformity of the flux in the air gap due to the slotted construction of the core carrying the winding. It will be appreciated that by means of this invention the need for this separate sleeve is avoided. To close the slots in the tubular core a cylinder of magnetic material may be drawn over the core and the magnetic path thereby completed.

In a specific construction the slots have parallel side walls and are of semi-circular form at the base extending close to the inner wall of the core. For direct current operated instruments this core may be machined from solid material with advantage in obtaining greater accuracy in production. The core used for indicating and repeating instruments, as aforesaid, should be formed of material having low hysteresis losses and low saturation flux density. Owing to the low saturation the flux losses due to leakage across the slots at the inner wall of the core are of little consequence.

Dated this 6th day of January, 1940.

BOULT, WADE & TENNANT,  
Chartered Patent Agents,  
111 & 112, Hatton Garden,  
London, E.C.1.

## COMPLETE SPECIFICATION

### Improvements in or relating to Dynamo Electric Instruments

We, S. SMITH & SONS (MOTOR ACCESSORIES) LIMITED, a British Company, of Cricklewood Works, Cricklewood, London, N.W.2, and EDWIN CLAUDE KLEPP, a British Subject, of the same address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

In electric motors for supplying motive  
[Price 1/-]

power by continuous rotation there is usually employed a stator comprising a field winding which is uniformly energised to provide a symmetrical field, this stator having pole pieces spaced around the armature, each carrying a coil of the field winding. It has been proposed for such motors to form the stator of a core having lengthwise slots open at the exterior of the core to receive the field winding in the form of finished coils the outer ends of

the slots being closed by a band or yoke around the core. Examples of such motors are described in Specifications Nos. 410,064 and 430,910. The present invention is essentially concerned with electric indicating or repeating instruments of the kind comprising a stator and a rotor, of which the stator has a winding in a plurality of sections distributed around the rotor and differently energised to a varying degree, for instance under remote control, so as to provide a resultant field distribution which is rotated according to the energisation of the windings, the rotor being controlled by this resultant field and so caused to take up any position within its range of operation according to the resultant field distribution to provide the indication.

Previously, in instruments of this kind the stator is formed by a tubular core having lengthwise slots, not necessarily parallel with the axis of the core, which slots are open at the inner wall of the tubular core. In instruments of the kind referred to the inner diameter of the core is small and the introduction of the conductors of the winding into the slots is extremely difficult, particularly if the total cross-section of the winding is large with respect to the size of the core. It is the object of the invention to overcome this disadvantage. The present invention comprises an electric indicating or repeating instrument of the kind referred to wherein the conductors of the distributed field winding are carried in lengthwise slots formed in the stator core and open at the exterior thereof. With this construction the winding may easily be introduced into the slots. The complete winding is preferably pre-formed with a group of conductors for each slot and is applied to the tubular core by pressing each group of conductors as a unit into the appropriate slot. The slots are preferably of maximum width at the outer wall of the tubular core to facilitate the application of the winding and the slots may be closed by a cylinder of magnetic material passed over the core.

The invention is particularly applicable to the electric indicating or repeating instruments described in Specifications Nos. 525,092 and 529,583. In these instruments it is usual to provide a sleeve of magnetic material in the air gap to minimise the non-uniformity of the flux in the air gap due to the slotted construction of the core carrying the winding. It will be appreciated that by means of this invention the need for this separate sleeve is avoided.

A specific application of the invention to an electric indicating or repeating

instrument is shown by way of example in the accompanying drawings, in which:—

Figure 1 is a perspective view of the rotor and stator with parts cut away;

Figure 2 is a cross-section of the rotor and stator with the winding ready to be introduced into the slots in the stator, and

Figure 3 is a winding diagram of the stator winding.

Referring to the drawings, the stator of the instrument comprises a tubular core 20 having an uninterrupted inner cylindrical wall 21 and twelve equally spaced lengthwise slots 1 to 12 open at the outer cylindrical wall 22 of the tubular core. These slots are of semi-circular form at the base and have their side walls diverging outwardly to facilitate the introduction of the winding.

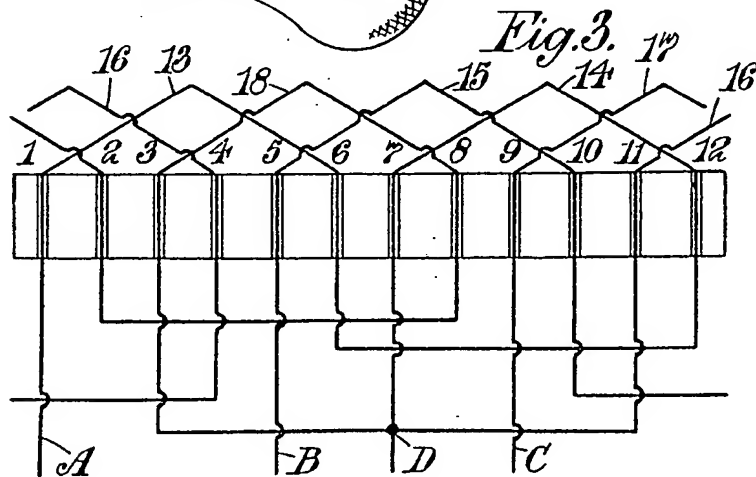
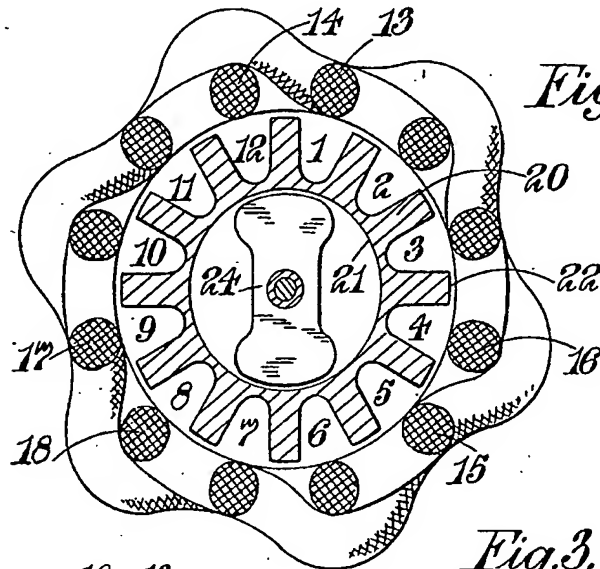
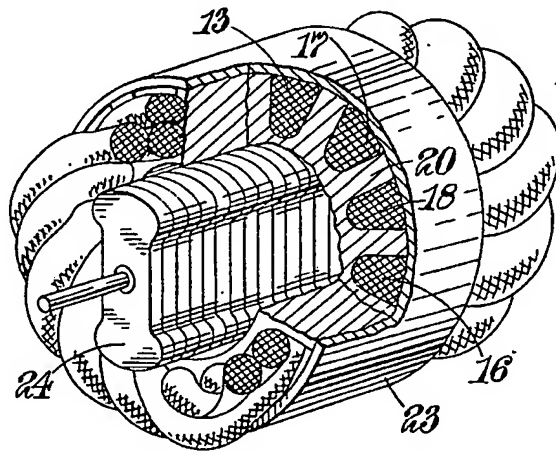
The winding is prepared separately from the core and consists of six coils 13 to 18. The winding is formed about a cylinder which is slightly larger than the external wall 22 of the tubular core, and the tubular core is then introduced into the winding, as indicated in Figure 2. The group of conductors constituting each winding is then pressed radially inwards to occupy the appropriate slot of the tubular core, as shown in Figure 1, and the winding is retained in position by means of a cylinder 23 of magnetic material drawn over the outer wall of the core, thus completing the magnetic path across the ends of the slots.

Referring to Figure 3, the winding is in three sections A, B and C, to provide a three-phase flux distribution, the three sections having a common terminal D. The section A consists of the coils 13 and 14, section B consists of the coils 15 and 16 and section C consists of the coils 17 and 18.

The rotor indicated at 24 is mounted in any convenient manner for rotation within the tubular core 20 and for a D.C. instrument consists of a permanent magnet which may be built of comparatively thick chrome steel plates of high coercivity to provide a large synchronous torque. For an A.C. instrument the rotor 24 is laminated and is provided with a suitable winding. For D.C. instruments the core may be machined from solid material with the advantage of obtaining accuracy in production. The core should be formed of a material having low hysteresis losses and low saturation flux density and owing to the low saturation the flux losses due to leakage across the slots at the inner wall of the core are of little consequence. For an A.C. instrument the tubular core may be laminated.

In the application of the invention to

- an instrument of the kind described in Specification No. 529,583, for example, the rotor is connected to an indicating pointer and in one use of the instrument 5 the three sections of the winding are connected to three equally spacedappings of a ring potentiometer having two diametrically opposite sliding contacts connected to an electric supply. Rotation of the con- 10 tacts on the ring potentiometer thus alters the current distribution in the stator winding of the instrument and so causes the rotor 24 to move to a position which is dependent upon the position of the contacts. 15 Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—
- 20 1. An indicating or repeating instrument of the kind specified, wherein the conductors of the distributed field winding are carried in lengthwise slots formed in the stator core and open at the exterior thereof. 25
2. A dynamo electric machine or instrument as claimed in claim 1, wherein the complete winding is pre-formed with a group of conductors for each slot and is 30 applied by pressing each group of conductors as a unit into the appropriate slot.
3. A dynamo electric machine or instrument as claimed in claim 1 or 2, wherein the slots are of maximum width at the 35 outer wall of the tubular core.
4. A dynamo electric machine or instrument as claimed in any of the preceding claims, wherein the slots in the tubular core are closed by a cylinder of magnetic 40 material passed over the core.
5. A dynamo electric instrument substantially as described with reference to the accompanying drawings.
- Dated this 28th day of June, 1940.  
BOULT, WADE & TENNANT,  
Chartered Patent Agents,  
111 & 112, Hatton Garden,  
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[This Drawing is a reproduction of the Original on a reduced scale.]